

elegance added would convey an idea of what the animal was doing.

I submit that the error which leads the experimenters so far is forgetting that the mechanism of the human eye has as much to do with the matter as the movements of the horse's feet.

Confining my argument to the gallop, I contend that the conventional extended attitude is true artistically, though it never actually takes place whilst the horse is at this pace. The eye (as is sufficiently proved by the need of machinery for finding out the actual motions of horses' feet) does not obliterate and receive impressions sufficiently quickly to trace the three paces in the gallop; but it can note the fact that at some moment during each bound, each of the four reach this extreme point. Now the feet are twice as long at this point as at any other, that is to say, the passing out over and returning along the last inch is for the eye a pause at the extreme. It is no more doubtful

that a galloping horse should be painted as it usually is, than that a swinging pendulum can only be suggested by drawing it at one or other extreme of its excursion. An artist could no more use Prof. Marey's diagrams in the way it is assumed he should, than he could represent a rolling wheel if he took no liberties with the apparent position of the spokes; but confined himself by remembering their true places and numbers, which of course are the same as when the wheel is at rest.

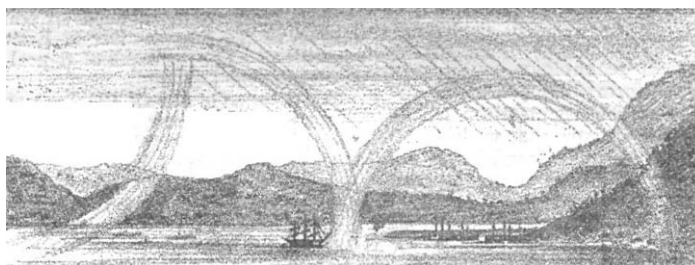
It is true that a galloping horse might also be represented with all its legs gathered under it, but this is not done, because, as I agree with Prof. Marey, "it is the artist's duty to add elegance of form;" whilst I dissent from him when he allows himself to be convinced that "the greater part of the horses [of Phidias] are represented in false attitudes" because the odograph says so.

W. G. SIMPSON

Edinburgh, November 12

### A Curious Rainbow

I SEND you a rough sketch of a curious rainbow group seen in Gareloch about 8.25 A.M. on October 20. I would have written sooner but I delayed till I had obtained sketches from several different sources. I only saw the junction of the two bows at C,



Road to Kilcreggan.

A

B

Roseneath. Row Point. Pier.

C

D

Row.

but the bay was quite calm. The bow D was perfectly full and bright, while B died away at its highest point. I can only imagine that B was formed by light reflected by some bright cloud, but I did not observe any bright enough. The view is nearly north-west. As I have never even among our Scottish

that being the only part of Row Bay visible from my standpoint, but several observers saw the whole group as I have drawn it. The sea was quite glassy, so that the inverted rainbow A must have been formed by the sun's rays reflected from the water. The wind was just beginning to rise and some scudding showers were passing up from the Firth of Clyde from the south-west,

hills seen such a combination of rainbows, I think the description may have some interest for some of your readers. The hill to the right is Knapps Hill, and is 2,000 feet high and three and a half or four miles distant.

J. B. HANNAY

Woodbourne House, Helensburgh, November 4

### How Snakes shed the Skin

IN NATURE, vol. xx. p. 530, Dr. H. F. Hutchinson, amid some interesting facts about snakes, says: "I have never witnessed the process of skin-shedding, nor, I believe, has any observer." The Doctor then ventures an ingenious, though incorrect, hypothesis of his own. In the *American Naturalist* for January, 1875, i.e., vol. ix. No. 1, under the title, "The Pine Snake of New Jersey," I gave an article embodying the results of several years' study of *Pituophis melanoleucus*, in which the process of exuviation is described as witnessed by myself. Herewith is an abstract. The few words interpolated for the sake of clearer exposition are put in brackets.

Near the close of September, 1873, at 1 P.M., looking into the box, I saw that the female snake had started the skin from her head. It was a little torn at the snout, and I found that the head and a little of the neck were denuded. The denuding process was going on, but very slowly. Doubtless the chief difficulty was in starting the skin, and I felt sorry that I did not see the start. The neck was very slowly becoming divested of the old cuticle, which, at first glance, had a sort of back-creeping aspect. What surprised me was the fact that there was not the least friction in the process; that is, there was no rubbing against any exterior object. It really did look as if an invisible power was drawing the skin back upon itself. [Looking closely, I caught the secret. There was a systematic alternate swelling of the body at the neck of the skin, thus stretching it, and making a shoulder in front of the neck, each swelling pushing the loosened skin a little backward.] The old skin at this time is very moist and soft, and any swelling of the body stretches and loosens it. So soon as the exuviation has reached the part of the body containing the larger ribs, this doffing of the old suit proceeds more rapidly, and with a singular system. It is done

just in this way: Exactly at the place where the skin seems to be moving backward, a pair of ribs expands. This action enlarges or puffs out the body, and by stretching loosens the skin at that place. In this movement both ribs in the pair act at the same time, just as the two blades of the scissors open together. Now comes a second movement of this pair of ribs, in which action the two ribs alternate with each other. One of them—say the one on the right side—is pushed forward and made to slip out of and in front of the constriction made by the swelling, when it immediately works backward, that is, against the neck of the double receding skin. Now the left rib makes a like advance, and in a similar manner presses backward. [Thus for every increment of exuviation, or backward movement of the inverting skin, three actions occur with rhythmic method; the expanding of one pair of ribs, the intumescence of the body at that spot, and the pushing back of the skin by the alternate action of each rib.] Thus the final action of each pair of ribs is not synchronous, but alternate, and has a notable sameness of movement and result with that of the alternate hitching of each side of the mouth when swallowing a large prey. Indeed, swallowing, with a serpent, is a misnomer, for that laborious hitching is not more a pushing of the prey down the gullet than a drawing of the body over it. The Western man said he always felt better after getting himself round a good beef-steak. With the serpent this is a literal fact; it puts itself outside of its victim. So with that singular costal action it seems to push the skin backward; but this is an illusion, for it actually pushes itself forward, pulling the skin out as itself advances out of the skin, thus with each movement or advance lengthening the inverted cuticle behind; that is, the old hose everts or evolves itself forward, though it appears as if by some occult force to be pulled on itself backward.

The ribs of a serpent, which extend nearly throughout its whole length, are very much smaller near the neck and near the tail. At both these parts exuviation is much slower than where the larger ribs have play in the process. This rib action produced an automatic movement of the snake on the floor of its box, and across the folds of its companion, which kept as still as if it were dead. This involuntary movement of the reptile's body was almost imperceptible. All told, it might have been through two feet of linear space. But the exuviated skin was nearly six feet long. This movement seemed much greater than it really was. It was emerging from a tubular case, which was doubling upon itself for a while, the inner or unevolved part shortening as it moved forward with the body; the outer, or evolved part lengthening as it moved backward from the body. The cast-off skin is presented inside out, so that every scale is now seen on its under or concave side, and this is also true of the eye-scales. To all this there is one exception: the last scale of the tail is a hollow pyramidal or four-sided spike. This, for plain reasons, is not everted. When the shedding has reached this scale a sharp shake of the extremity is sufficient, and the uneverted spike is left inside of its everted skin. The entire process of exuviation, allowing five minutes for the part that I did not witness, took thirty-five minutes.

Let me add that in poor health a snake has a hard time in getting off its old coat. I could detail an instance wherein the process took three months. The old skin adhered stubbornly to the new one, and was only removed by friction and by tearing off mere bits at a time.

SAMUEL LOCKWOOD

Freehold, New Jersey, U.S.

#### The "Hexameter," Πᾶσα δόσις ἀγαθή . . .

THERE is an obstacle in the way of regarding this passage (James i. 17) as a hexameter quoted by the Apostle from some poet, as the late lamented Prof. Clerk Maxwell is reported in Mr. Garnett's interesting notice of his life, work, and, not least, his character, to have suggested. The final syllable of *δόσις* is short, as the accentuation of *πράξις* and similar verbal nouns proves. *Ἀρσις*, as in "Βέλος ἔχευενύκης," Il. α, 51, can hardly be pleaded.

J. J. WALKER

University Hall, W.C., November 17

#### THE SWEDISH NORTH-EAST PASSAGE EXPEDITION<sup>1</sup>

DURING the wintering of the *Vega* large quantities of the bones of the whale were found on the beach. These at first were supposed to be the remains of whales that had been killed by the natives or by American whalers. On examination it was found that they must be sub-fossil. This was confirmed by the natives, who stated that no whale had driven on land in the memory of man. The remains were found to belong to four or five different species, of which *Balæna mysticetus*, or a nearly allied type, was the most common.

Prof. Nordenskjöld investigated the formation of the strata of frozen earth several hundred feet thick which occur in Siberia as in Polar America. Along the coast of Siberia there is a stratum of water resting on the bottom of the sea which is several degrees below the freezing-point, so that a flask of the comparatively fresh surface water, when sunk into this stratum, begins to freeze. Stuxberg observed that the trawl-net often froze fast to the bottom. This was accounted for by the freezing of the fresh water which the net carried down with it from the surface. Nordenskjöld thinks that the mud carried down by the rivers into the sea as it sinks to the bottom carries with it fresh water adhering to the minute particles, and that this fresh water, like that carried down by the net, freezes at the bottom, forming thus a frozen stratum, which increases year by year until it reaches an enormous thickness. He is of opinion that a portion of the earthy layers of Siberia was formed in this way, although, he adds, he by no means considers this the only way in which such formations arose.

Along the whole coast, from the White Sea to Behring's

Continued from p. 40.

Straits, no glacier was seen. During autumn the Siberian coast is nearly free of ice and snow. There are no mountains covered all the year round with snow, although some of them rise to a height of more than 2,000 feet. With one exception there were no rocks along the coast precipitous enough to be suitable breeding-places for sea-fowl, but a large number of these birds were seen during spring flying farther to the north.

During the voyage of the *Vega* from her winter quarters through Behring's Straits and farther south, Nordenskjöld searched for a tribe called Onkilon, said to be allied to the Eskimo, but without success. He found only reindeer-owning Tchuktches, and supposes that the name Onkilon, given by Wrangel to the old tribe inhabiting the coast and driven out by the Tchuktches, is probably related to the name Ankali, given by the reindeer-owning Tchuktches to the coast Tchuktches. Nordenskjöld states that English authors who refer Eskimo and Tchuktches to the same origin are mistaken. It was found that the inhabitants on the American side are pure Eskimo, with whom it was possible to carry on barter by means of the list of Eskimo words published in "Arctic Geography and Ethnology," London, 1875; but that the language spoken by the Tchuktches, of which Lieut. Nordquist collected about 1,000 words, is quite different, and probably allied to that of the Iranian races. On the other hand there is a complete correspondence between the household furniture of the Tchuktches and the Eskimo. It may be safely affirmed, he says, that these two neighbouring races have a greater number of identical articles in their tents than of common words in their languages.

The hills at Cape York on the American side were found to consist of crystalline schists without organic remains. Among the natives, who were Eskimo, there was a Tchuktch woman who said that Tchuktch tribes were settled on the American side between Point Barrow and Cape Prince of Wales. The Eskimo used, along with breechloaders, revolvers, and axes obtained from the Americans, bows and arrows, bone boat-hooks, and various stone implements. They were friendly and agreeable, and less given to brandy than the Tchuktches. There did not appear to be any chief among them. Complete equality prevailed, and the standing of the women did not appear to be inferior to that of the other sex. Among the stone implements were found arrow-heads and other articles of a species of nephrite so closely resembling the well-known nephrite from High Asia, that these implements were supposed to have actually come from that region.

A warm current, as in Europe, was found to flow along the north-western coast, and to create there a far milder climate than that which prevails on the Asiatic side. The limit of trees therefore lies a good way to the north of Behring's Straits, while the whole of the Tchuktch Peninsula appears to be devoid of trees. This is the case also with the land along the coast at Port Clarence, but a short distance inland there were bushes two feet high. Vegetation was generally luxuriant, and a great number of species were identical with, or nearly allied to, those of the Scandinavian north, among others the *Linnea*. Notwithstanding the luxuriance of the vegetation, the land invertebrates were much poorer in species than in the north of Norway. Thus only from ten to twenty kinds of beetles could be found, principally *Harpalus* and *Staphylini*, and of land and fresh-water mollusca only seven or eight species. The avifauna was also rather scanty, and the dredgings in the harbour at Port Clarence, on account of the unfavourable nature of the bottom, yielded only a small number of animal and vegetable species.

The *Vega*, crossing to the Asiatic side, anchored in Konyam Bay on July 28. On the north shore of this Bay Dr. Kjellman added seventy species of flowering plants to the collection he had previously made. Here, too, were